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ABSTRACT

Due to the implementation of a credit-based system in the Hong Kong Polytechnic University, it is anticipated that a large number of students will be taking some popular common service computing subjects. These subject modules may be taught by different teachers; thus there is a need to ensure that students are taught uniformly with the same teaching materials. It is likely that mass lectures will be used in a credit-based system, and well-prepared teaching materials must be available for effective learning and teaching. A set of common teaching materials to be shared by several staff can make staff resources better deployed. This paper is concerned with the development of the multimedia teaching materials in a common service subject, information technology. A CD-ROM which contains the multimedia teaching materials has been produced. There is no doubt that the development process requires hardware, software, and human resources. The characteristics of the teaching materials, the development process, the structure of presentation materials, and the problems encountered in the development of multimedia teaching materials using Microsoft PowerPoint version 7 are described. (MES)

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DEVELOPMENT OF MULTIMEDIA TEACHING MATERIALS FOR A COMMON SERVICE SUBJECT IN INFORMATION TECHNOLOGY

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It is anticipated that a large number of students will be taking some popular common service computing subjects in a credit-based system. These subject modules may be taught by different teachers; thus there is a need to ensure that students are taught uniformly with the same teaching materials. It is likely that mass lectures will be used in a credit-based system and well-prepared teaching materials must be available for effective learning and teaching. A set of common teaching materials to be shared by several staff can make staff resources better deployed. This paper is concerned with the production of the multimedia teaching materials in a common service subject. A CD-ROM which contains the multimedia teaching materials has been produced. The development of multimedia teaching materials has been undertaken in a common service subject, Information Technology. There is no doubt that the development process requires hardware, software, and human resources. This paper describes the characteristics of the teaching materials, the development process, the experience of the author, and the problems encountered in the development of multimedia teaching materials using Microsoft PowerPoint version 7.

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INTRODUCTION

In view of the implementation of a credit-based system in The Hong Kong Polytechnic University starting September 1998, there will be a large number of students wanting to study some common subject modules in Computing. This popular subject module will be attended by many students and may involve several teachers. There is a need to ensure that students are taught uniformly with the same teaching materials. High quality teaching materials must be available for effective learning and teaching. A set of common teaching materials to be shared by several staff can make staff resources better deployed. The use of multimedia was applied to teach telecommunication (Yaverbaum and Nadarajan 1996). Also, multimedia can be used in educational settings (Smith 1997). The author undertook a Hong Kong University Grants Committee-funded Learning & Teaching project which was to develop teaching materials tailor-made for a common service module. The project consumed about US$5550 for the hiring of student assistants to be involved in the project. This paper is concerned with the production of the multimedia teaching materials in a common service subject in Information Technology. A CD-ROM which contains the multimedia teaching materials has been produced.

The development of multimedia teaching materials has been undertaken in a common service subject, Information Technology. There is no doubt that the development process requires hardware, software, and human resources. This paper describes the characteristics of the teaching materials, the development process, the experience of the author, and the problems encountered in the development of multimedia teaching materials using Microsoft PowerPoint version 7.

CHARACTERISTICS OF THE TEACHING MATERIALS

The service subject module, Information Technology includes topics on hardware, software, data communication, the internet, databases, information systems, and software packages. The subject is designed as an introductory subject in Information Technology. The teaching materials have been prepared with multimedia for a professional-look presentation and they are all contained on a CD-ROM. The materials provide

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consistent and common coverage for all teachers of the subject. As the lecture materials are readily available on a CD-ROM, the delivery of a lecture can be easy when the lecture room has the necessary equipment which includes a computer with CD drive and sound capability, a projector and a screen.

There is a main menu (see Figure 1) through which lecture topics are to be selected with an icon-based interface. This can be convenient to a teacher as there is no need to remember the file names of the various topics. The materials in each lecture topic are well-organized with suitable video, audio, clip art, and photos to hold the attention of the students. Diagrams, charts, tables, and short video clips have been included for illustrations.

It was decided that the materials should have a good presentation format. Every slide is provided in the most appropriate presentation format with good combination of text and background color to attract the attention of the students. Bullets and font size have been carefully chosen to add emphasis to the presentation materials. Templates have also been applied carefully. Students in the past commented that they prefer to have color transparencies in lectures. Some of the important points are highlighted with color to focus students' attention. Different topics use different colors to give a fresh appearance. Most of the slides are supported with note pages which can supplement the details of each of the text lines in the slides. Each topic is provided with references including World Wide Web (WWW) addresses from which students and teachers can purse further information about topics.

DEVELOPMENT PROCESS

Choice of Development Tools

The development of multimedia teaching materials can be performed using authoring packages e.g. Toolbook which offer a number of special effects and interactive controls. The disadvantage is that a certain amount of programming is required. Most teachers may not have the time to be involved in programming in the preparation of teaching materials. They are already busy being involved with other important activities such as research, administration, lecturing, giving tutorials, and marking assignments. Indeed, they require an effective presentation tool to assist them in the development of teaching materials for presentation. Furthermore, the materials should be able to be enhanced and/or modified without much effort.

Microsoft PowerPoint is a very popular presentation tool used extensively in both the academic and business environments. PowerPoint has the advantage that a teacher does not need to know the technical aspects of programming to use the software. PowerPoint facilitates the development, modification, and subsequent enhancement of presentation materials. Coles and Rowley (1996) and Fulton (1997) have described the facilities for effective presentation using PowerPoint.

Development of Multimedia Teaching Materials

The project involves multimedia which may include text, graphics, video-clips, photographs, and sound. The first step was to collect the latest information on Information Technology and prepare the text. A considerable amount of typing was necessary. The next task was to add multimedia objects and other special effects to the text. The materials were first developed using PowerPoint version 4 under Windows 3.1 and these materials were later transferred to PowerPoint 7. Most of the teaching materials (slides) are supported with note pages which can supplement the details of the main points in the slides. References and WWW addresses are added to the end of each topic so that teachers and students can make further investigations. In order to attract the attention of students, every slide is provided in the most appropriate presentation format with good combinations of text and background color. The template and bullets and font size have been carefully chosen. Some of the important points are highlighted with color. Some slides have been built with animation effects; for example, the typewriter text effect and laser text effect. The teaching materials have different fonts including Times New Roman, Arial, and Garamond, among others. The application of the Book Antiqua font gives a smooth and appealing appearance. Also, 'Handwriting' and 3D fonts have been included to give the presentation a special appearance. An icon-based user interface was later developed and the presenter can choose the topic to be presented by clicking the appropriate icon.

Hardware and Software Facilities for Multimedia Development

To save time and effort, it would seem logical to use readily-available multimedia object clips which can be purchased from third-party vendors and perhaps downloaded from the Internet. Many video clips were found to be not appropriate to the subject under development. It was decided to produce them directly.

However, before the multimedia objects can be produced, there is a need to know how to use both hardware and software facilities. One major issue was the lack of hardware and software in my department and also the lack of technical support in using these facilities. The lack of manuals was also one of the problems. Sometimes, the access of hardware and software facilities was made from other departments. For example, The production of the video clips and the production of the CD-ROMs required the help of the Educational Development Unit of The Hong Kong Polytechnic University. The following table summaries the hardware and software facilities that have been used in the production of teaching materials.

TABLE 1
MULTIMEDIA OBJECTS

Multimedia Objects	File Format	Software Requirement	Hardware Requirement
Sound(music)	*.wav	CoolEdit	Sound Card (Sound Blaster)
Video	*.avi	Adobe Premiere	Digital Video Camera Video Capture Card (Video Blaster)
Sound(Midi)	*.mid	Nil	Sound Blaster
Spoken sound	*.wav	Sound Recorder	Microphone
Presentation	*.ppt	PowerPoint	Nil
Photo	*.jpg *.bmp	PhotoShop 4.0 PhotoEnhancer	Digital Camera (Kodak)
Scanned image	*.jpg, *bmp	HP desk scan	HP Scanner
Clip arts	*.wmf	Clipart CDs	Nil
CD-ROM production	Nil	EasyCD Prol	Jazz or Zip drive CD-Writer
Diagram	Nil	PaintShop Pro	Nil

Production of Multimedia Objects

Video Clips. It is useful to present short video(s) in lectures to enhance learning and to stimulate the students' interest. It was felt that relevant video clips could be produced to show some situations that they have not seen before. Sometimes students may not be allowed to access an environment unless arrangements have been made. e.g. a computer center in which all hardware devices are installed. Many of them may have seen and used a PC but they have not seen a super computer or a file server. They have an opportunity to see the full environment of a computer center which is quite different from that of a PC terminal room. However, video clips can be down-loaded from the WWW or purchase from third-party vendors. It can also be time consuming to search for relevant clips to be incorporated into the teaching materials.

The production of good image quality video clips may require a digital video camera; otherwise, snapshots can be digitized using a scanner. One can adjust the resolution of the image. When a higher resolution is chosen, a larger file size will be required. For better quality of video effect, it is advisable to skip the beginning and the last portion of the video shot for later editing with transition effect. Video recording and editing software such as Adobe Premiere is required for accepting input from the digital video camera and for subsequent editing. It is also advisable to have several shots of the same scene before selecting a video for digitizing. Each video should be edited and compressed before linking to the presentation.

Incorporating multimedia objects in presentations requires many technical decisions. The Audio Video Interleaved (AVI) format is a convenient format for video clips which can be inserted into the presentation. Some videos are in QuickTime format which requires a QuickTime player for the show. The size of a video file occupies less space if it is in MPEG format. For example, a file in AVI format occupies 120MB/Min compared with a MPEG file of 18MB/Min. That is approximately seven times larger. It seems logical to convert AVI files to MPEG format. This can be done using file conversion software such as Xing Encorder. With an MPEG file, Xinger Player needs to be installed for the show. Moreover, a faster computer is required for playing the MPEG file as the file is compressed and subsequently re-converted at the time of playing. Thus, a particular file format requires an

appropriate driver and player. It is essential to use a Jazz or Zip disk for backup and to work with in the subsequent editing processes. Because of size and speed considerations, the use of the ordinary 1.44 MB floppy disk is out of the question. Sometimes, a relatively small file can be compressed to store on a floppy disk and then de-compressed for using. When a presentation has video clips, the time taken to save, load and play the presentation slides is much longer. For example, it has been found that a 23.6 MB multimedia presentation file requires 1 min. 50 sec. for saving to hard disk. The problems with handling presentation materials with multimedia objects are the large file sizes. It is preferable to use a Jazz storage device for storage and for speedy backup. Windows 95 has a known problem that the system can fail easily. There have been some occasions when the original file was corrupted when the file was being saved to the hard disk.

Photo Clips

Students may not have seen equipment such as an uninterruptible power supply, a repeater, line printers and others. These real objects can be brought to the class environment for demonstration or illustration. A digital camera can be used to create a picture of interest to be inserted into the presentation. Normal cameras have better quality. Digital cameras are easier to use. One additional feature is the ability to change the resolution of the image. Software is required to convert the digital camera format to that of a photo image format such as JPG. A photo image can be either JPG or BMP format and the JPG one occupies less space. However, Digital Photo format needs to be compatible with PowerPoint 7. A black and white image requires less disk space compare with color images but color pictures are more informative to students.

A scanner can be used to capture an image of a standard photograph. In fact, any object with a flat surface can be considered for duplication using a scanner rather than taking a photo. e.g. an image of a smart card. Experience has shown that the original picture should not have a glossy or bright color surface in order to obtain a good quality image. Some illustration materials can be scanned and then later incorporated into presentations.

Audio Clips

It may be worthwhile to include short music at the beginning of a lecture when all students have not yet arrived. The first slide of the presentation (with the heading of the topic) is the logical place to insert a light music clip. The idea is not to provide entertainment to students but rather students can be able to relax a while before the lecture starts. Some topics are not interesting but they are important. e.g. a topic on standard documentation which may not be easy to stimulate the interest of the students but a relaxed environment may help. It took some time to choose some light and relaxing music to be played. Audio editing software can be used to edit an audio sound track from a regular music CD and select the best tone of it. The music can repeat itself again when it comes to the end. This also reduces the size of the audio file. There are many sound recording formats. Most presentations use 16 bit sound at 22khz which is quite adequate when sound is inserted as a media clip. The media player must be used to control the sound. The sound file used in this project is 8 bits at 11 kHz with mono play which will take up less file space compared with a sound file of the same length of 16 bits at 44 kHz with stereo play. e.g. A song which lasts for 2 minutes 47 seconds with 8 bits 11 Hz requires 1.8 MB whereas with 16 bits 44.1 kHz requires 28.8 MB.

After the music/midi clip has been inserted in the slide, an icon representing the clip, (a *thumbnail)* will appear on the slide. The music/midi will automatically be played once the slide has been loaded. The audio will be terminated once another slide is to be shown. In order not to show the *thumbnail*, the size of the icon has been resized to a small dot and it is hidden in the dark area of a picture on the slide. However, it is sometimes difficult to locate the dot. For maintenance purpose, another solution would be to place a rectangle object (with no border and colored the same as the background) in front of the icon.

Teaching materials can be inserted with spoken sound. The video clips have been incorporated with spoken sound. The decision was not to include spoken sound in the teaching materials more than necessary otherwise it will turn into self learning material. It may have impact on teachers if more and more self learning materials are produced. It is generally agreed that students should be taught by teachers in lectures. Later, students can use other facilities to assist them to learn.

Clip Art

The Microsoft Clipart Gallery has a good number of graphics available. Clip art can be inserted not only to add interest to a presentation and they can be informative. Sometimes, they can emphase specific points and have special effects. For example, a pair of scissors is to be included in a presentation when talking about the Delete function of word processing software. Clip art can be obtained from a number of sources: the clip art file within

PowerPoint, third-party software vendors, downloading from the internet, scanned images, and drawings. The presentation materials used in this project were obtained from the Clip Gallery as well as cartoon clip art from a third-party vendor. One must be careful not to violate copyright of designated materials.

STRUCTURE OF PRESENTATION MATERIALS

The teaching materials for each topic were first developed and each topic forms a file and can be used directly for presentation. A main menu has been prepared to serve as a link among the lecture topics and to provide an easy human-computer interface. Each topic is associated with an icon which can be selected by clicking it. Each topic consists of a number of slides some of which have been linked to multimedia objects. Each slide within a topic can be linked to multimedia object(s) which can be linked to another slides and can be linked back to itself after invoking. The topics of presentation materials are arranged in a multi-level tree menu fashion. The main menu and sub-menus provide an icon-based interface from which the teacher can choose a topic by selecting the required icon and the relevant materials will be loaded for use.

The main menu has a rotating logo of the university. The visual impact of the slide is the combination of the background color, the text color and the well-chosen icons. Light music will automatically be played once the slide has been loaded. Figure 1 below shows the main menu and Figure 2 demonstrates the sub-menus.

FIGURE 1
MAIN MENU

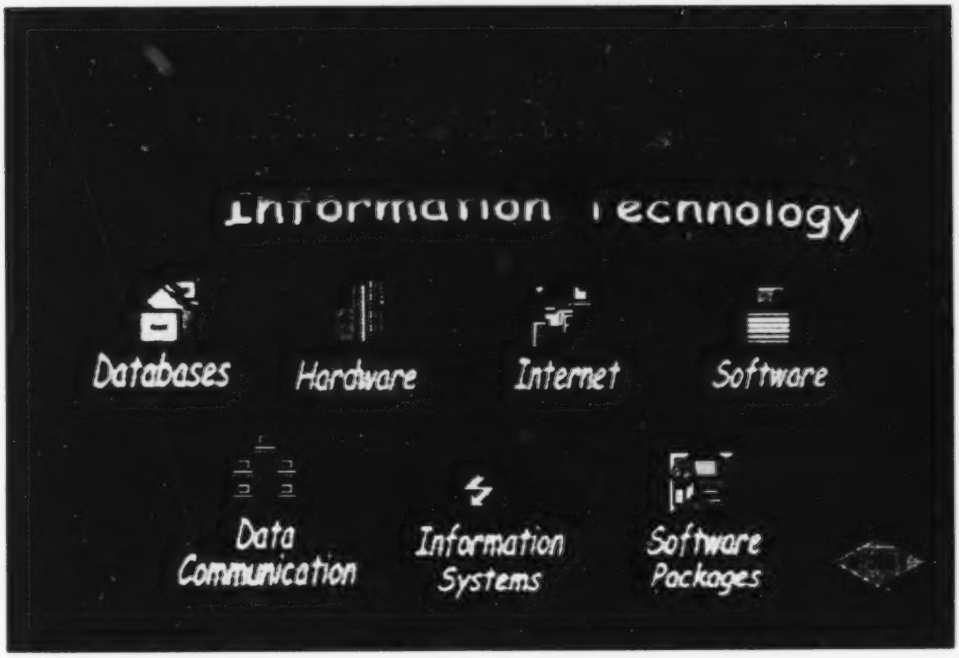
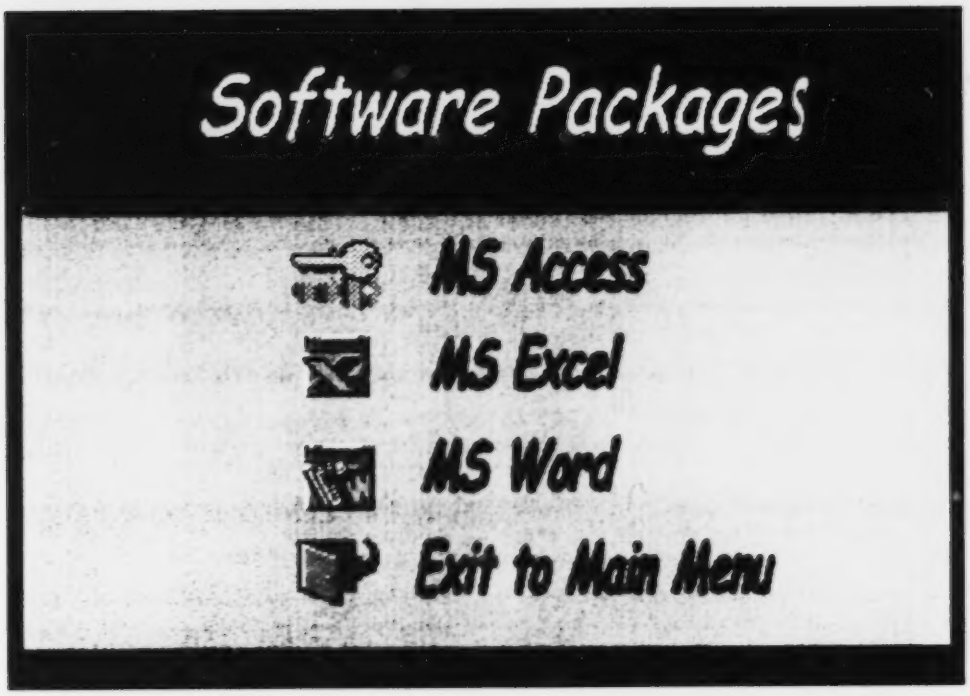
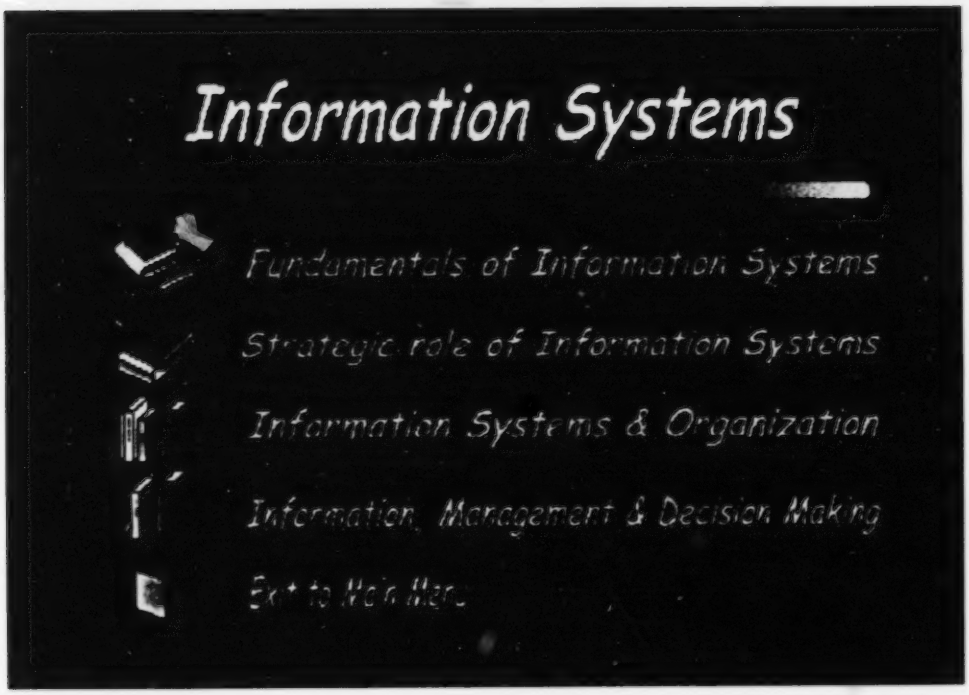


FIGURE 2
SUB-MENUS




Information Systems
Fundamentals of Information Systems
Strategic role of Information Systems
Information Systems & Organization
Information, Management & Decision Making

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BURNING OF CD-ROM (COMPACT DISK-READ ONLY MEMORY)

Because of the large file sizes that are involved with multimedia materials, it is beneficial to have a CD-ROM as an end product which holds all information on one disk. It will be more convenient for the teacher to carry the CD-ROM to the lecture theater assuming that a computer with CD drive and projection unit are available. When files sizes are large, we need to consider loading time & system requirements. The following table provides some examples of multimedia objects of large file size:

TABLE 2
LARGE FILE TYPES

File Types	Playing Time	Size
Video (*.avi)	C_room.avi (26 Sec)	14.91 MB
	Superc_1.avi (42 Sec)	25.16 MB
Music (*.wav)	DataBase.wav (3.55 Min)	2.59 MB
	DataCom.wav (4.22 Min)	2.89 MB
Midi (*.midi)	A_bridge.mid (40.53 Sec)	7.33 K
Scanned image	Nil	1.97 MB
Photo (*.BMP)	Nil	1.97 MB

The process of creating a CD-ROM is accomplished using a CD-ROM writer. Several versions of the PowerPoint materials were produced before the final version evolved. It was found that not every copy of CD-ROM could be successfully produced. The early production could be read by some computers but not by the others. The reason was due to the incompatibility of the Windows version chosen for the development of the material and the subsequent production of the CD-ROM. For example, the burning of the CD-ROM used Windows 97 and the development of teaching materials used Windows 95. One end result was that an AVI formatted file could not be played.

PROBLEMS ENCOUNTERED

PowerPoint offers a number of attractive templates of bright colors and different designs. It was first tempting to select these attractive templates, some of which have colorful borders. As some slides contain considerable amounts of information to be presented, it was found that these templates were not appropriate because the borders took up too much space. Thus a plain background was chosen.

Drawing tools provided by PowerPoint version 7 are not effective for drawing graphics/pictures/charts. Other drawing software had to be used instead and then the resultant pictures imported into the PowerPoint presentations.

The color combination of slides is dependent on the color resolution of the monitor. Different monitor models will have different effects on the same slides. Some high resolution monitors will have much more color combinations than low resolution monitors. It is recommended to be consistent when producing and showing the slides with the same setting. The best way is to develop the materials using 256 colors on low resolution monitors then the appearance will be predictable on all machines.

Windows 95 is renown to be unstable and files may have been corrupted in the middle of editing. It is advisable to save the working file as often as possible. When large files are used, the time taken could be significant when the mass storage was not used. Mass storage devices such as Jazz or Zip drives were needed because multimedia object files are very large.

Students expect multimedia to be of the quality that appears on TV. Therefore, any video clips, for example, need to be new, interesting, informative, and high quality. The presentation designers need to incorporate visuals, for example, supercomputers, tape libraries, and smart cards.

CONCLUSION

The author has described the experience of producing a multimedia support tool for a common service subject, Information Technology using PowerPoint version 7. The preparation of multimedia teaching materials is a time-consuming process. It requires a great deal of resources in terms of human, hardware, and software availability. It required long hours of project management efforts in checking and proof reading the materials. More importantly, it requires intensive technical support. The development of multimedia teaching materials requires considerable thought in incorporating meaningful audio and video files into the presentation. The materials can be further enhanced with PowerPoint 97.

There are a number of questions which need to be addressed. One question is "Should teachers spend so

much time and effort in producing multimedia materials to stimulate the interests of the students to learn ?". Many academic departments may not have the resources to support this kind of work. However, it is generally agreed that if students are motivated to learn, the task of teaching can be easier. The use of multimedia presentations can help to enhance the learning and teaching process.

Further research should be made to investigate the cost effectiveness of using multimedia presentations in teaching. Another research question is "How much better students can learn with multimedia presentations?". Can all subjects apply multimedia technology to all levels of students successfully? Considerable amounts of time and resources are required of academics who also have research and administrative demands.

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